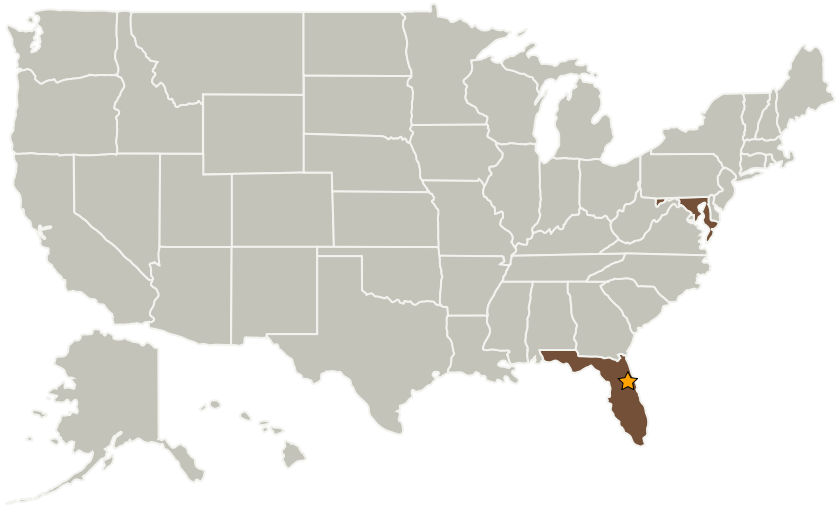
# Passive Wireless Hydrogen Sensors Using Orthogonal Frequency Coded Acoustic Wave Devices, Phase II

Completed Technology Project (2007 - 2009)

## Project Introduction

This proposal describes the continued development of passive orthogonal frequency coded (OFC) surface acoustic wave (SAW) based hydrogen sensors for NASA application to distributed wireless hydrogen leak detection systems. These novel sensors use an OFC SAW device structure, combined with Palladium (Pd) nanocluster film elements and hydrophobic self assembled monolayer (SAM) coatings to produce fast, reversible, highly sensitive hydrogen sensors capable of detecting a wide range of hydrogen concentrations at room temperature. The technical feasibility of these sensors was clearly demonstrated in Phase I. The Pd films experience conductivity changes due to the hydrogen induced stretching of the Pd nanoclusters and the quantum nature of conduction in nanocluster films. The performance of the SAW device will change in response to a change in conductivity of this film. Rapid (under 1 second) room temperature detection of hydrogen was observed, with complete reversibility of response. Compatibility of film conductivity with acoustic wave propagation and detection of changes in film conductivity using variations on SAW device delay were confirmed. Manufacturing compatible processes for SAM deposition and patterning were developed. The successful elimination of the potential technical risks accomplished in this Phase I effort provides a sound basis for further development of these sensors.

## Primary U.S. Work Locations and Key Partners

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## Organizational Responsibility

**Responsible Mission Directorate:**

Space Technology Mission Directorate (STMD)

**Lead Center / Facility:**

Kennedy Space Center (KSC)

**Responsible Program:**

Small Business Innovation Research/Small Business Tech Transfer

**Small Business Innovation Research/Small Business Tech Transfer**

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| Organizations Performing Work | Role | Type | Location |
|---|---|---|---|
| ★Kennedy Space Center(KSC) | Lead Organization | NASA Center | Kennedy Space Center, Florida |
| SenSanna Incorporated (formerly Applied Sensor Research & Development) | Supporting Organization | Industry<br>Women-Owned Small Business (WOSB), Veteran-Owned Small Business (VOSB) | Arnold, Maryland |

| Primary U.S. Work Locations | |
|---|---|
| Florida | Maryland |

## Project Management

**Program Director:**

Jason L Kessler

**Program Manager:**

Carlos Torrez

## Technology Areas

**Primary:**

- TX13 Ground, Test, and Surface Systems
  - TX13.2 Test and Qualification
    - TX13.2.7 Test Instruments and Sensors